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The Performance Evaluation and Optimization of the Light Concentrator for the Hyper-Kamiokande Photodetector

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Hyper-Kamiokande is a water Chenrekov detector, that is composed of a cylindrical tank with a diameter of 74 m and a depth of 60 m filled with ultra pure water.
Forty thousands of optical sensors look inside to catch Cherenkov light generated underwater.
We can reconstruct momentum, direction and particle type from Cherenkov ring imaged from cone shaped Cherenkov light.
Detection efficiency is important in Hyper-Kamiokande, therefore we examined a mirror to improve the photoelectron collection efficiency.

The purpose of this study is to evaluate the performance of the light collection (LC) mirror and optimize the design of LC.
Various shapes of the LC such as a height and a curvature is simulated using WCSim, which is a GEANT4 based program for developing and simulating large water Cherenkov detectors.
As a result of the simulation, one of LC shapes brings 1.4 times more photoelectrons collected than that without the LC.
With checking the impact on the events close to the wall and reflections, the best LC shape for Hyper-Kamiokande is studied with a measurement.

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